IPv6 Test Bed for Testing Aeronautical Applications

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Objectives

- Test Bed designed to foster research into using IPv6 for Aeronautical Communications and Services.
- Foster IPv6 research to build towards ICAO standardization activities.
- Understand the transition approach for addressing and interoperability.
- Demonstrate secure ATM applications.
- Publish international proceedings defining the use of IPv6 in Aviation.

Eurocontrol Network

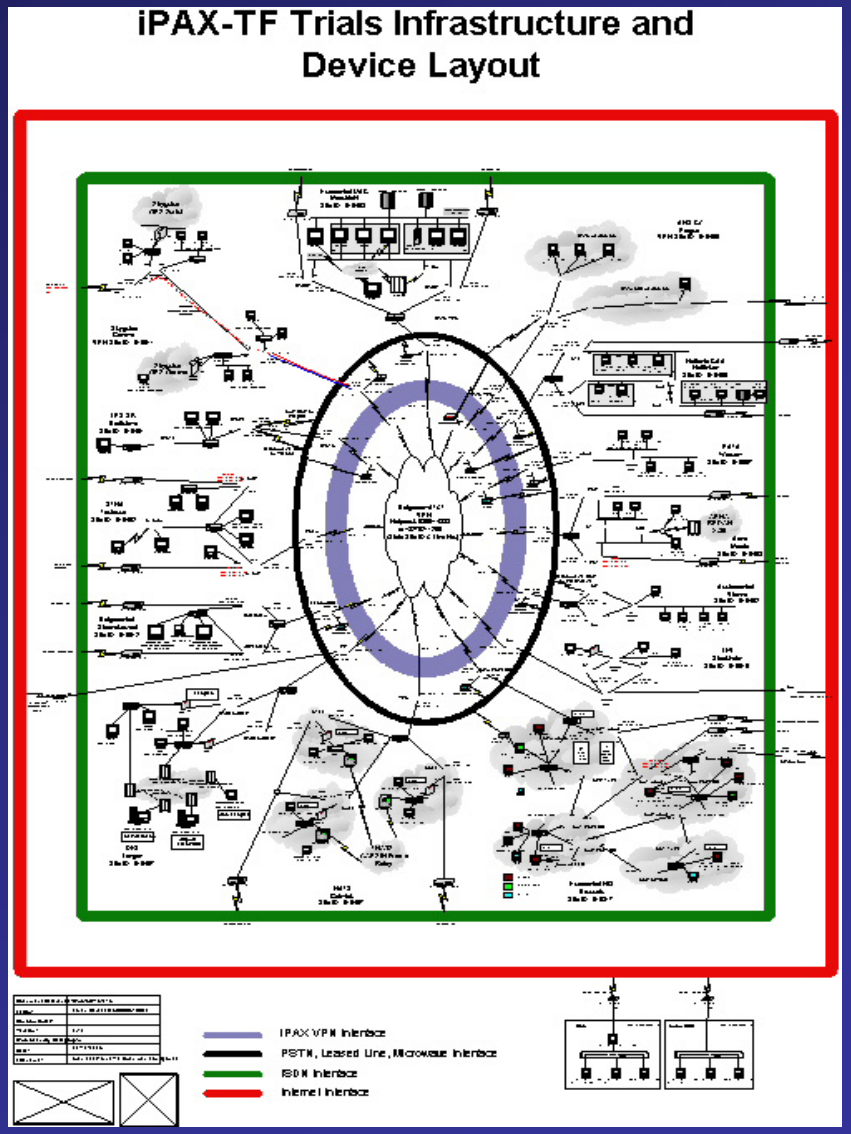
This network map describes the connectivity of the experimental IPv6 network and it's participating neighbors.

There are 18 neighbor sites connecting in a mesh configuration back to Eurocontrol. The neighbor sites are all member states of the Eurocontrol Air Traffic Control network.

Most connections are native IPv6. 6-in-4 tunneling was used only where there was no other reasonable option to connect.

This network test came about because of the announcement by Nortel to discontinue sales and support of legacy X.25 network hardware and software.

The end goal of this network is to verify that IPv6 can be used reliably, and efficiently, as a means to interconnect legacy ATC systems in a modern network world.



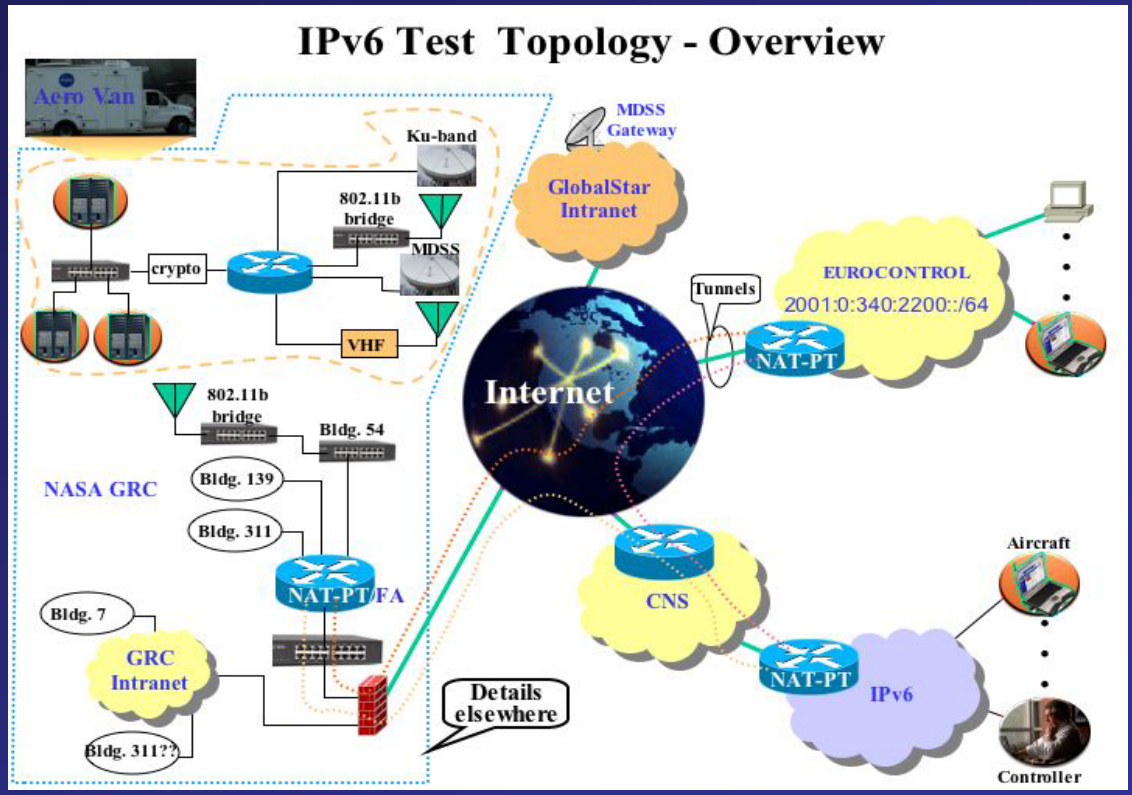
GRC / CNS Network

This diagram describes the network in place between Eurocontrol, CNS, and NASA Glenn.

It relies on the public internet for connecting the different physical locations together.

The Ku-band satellite terminals are Glenn-centric. They are used to communicate between the AeroVan and Building 311 at NASA Glenn.

NAT-PT is used to translate IPv4 to IPv6, and vice versa.



The MDSS (Medium Data-rate Satellite System) is an L-band system designed to be flown on large corporate and transport category jets. Globalstar provides the space segment and ground stations. Their network is NAT'd IPv4. Special arrangements had to be made to allow the MDSS terminal to participate in the IPv6 experimental network.

Mobile IPv4 (NEMO) is currently used to support network mobility requirements. A transition to Mobile IPv6 is planned.

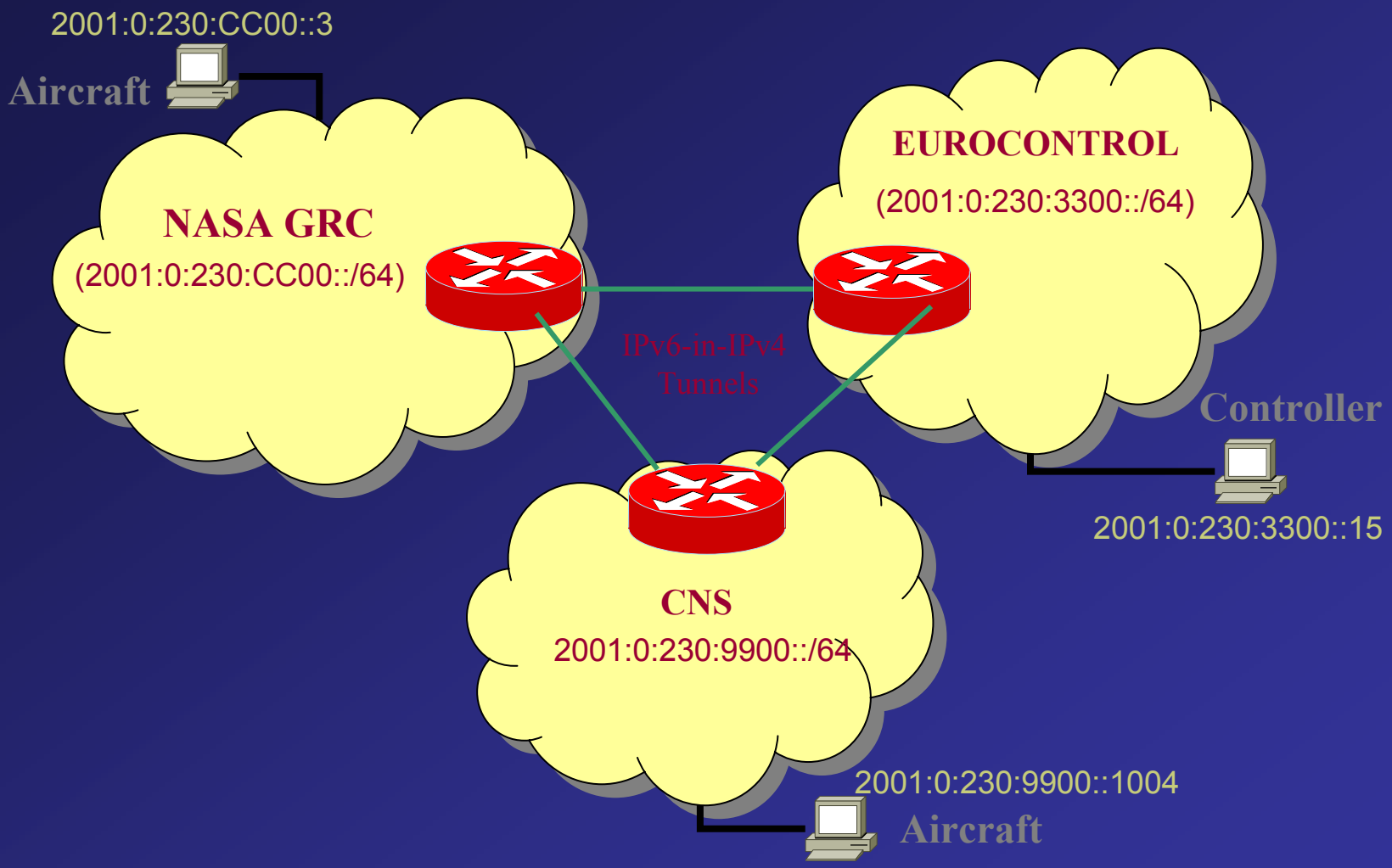
Phase I - Project Status

Task	Status	Closing Date
• IPv6 Ping		
– Identification and procurement of operating system/test Machines	Updated (Red Hat Linux 8.0)	03/25/2003
– Configuration of IPv6 on Test Machine	Completed	03/06/2003
– IPv6 to IPv6 Ping (Internal test network configuration I)	Completed	03/12/2003
– IPv6 over IPv4 tunnel Ping (Internal test network configuration II)	Completed	03/13/2003
– Request IPv4 Address of tunnel end point at EUROCONTROL from NASA/EUROCONTROL (Configuration I)	Completed	05/12/2003
– IPv6 Address allocation from EUROCONTROL	Completed	04/01/2003
– Testing of IPv6 ping with NASA GRC	Completed	08/07/2003
– Testing of IPv6 ping with EUROCONTROL/NASA	Completed	04/30/2003
• CPDLC Over IPv6		
– Modification to CPDLC application to migrate from IPv4 to IPv6	Completed	03/10/2003
– Testing of CPDLC on IPv6 (Internal test network)	Completed	03/14/2003
– Testing of CPDLC on IPv6 over IPv4 tunnel Ping (Internal test network)	Completed	03/14/2003
– Configuration/Installation of CPDLC on NASA/EUROCONTROL node	Completed	04/15/2003
– Testing of CPDLC over IPv6 with EUROCONTROL	Completed	04/28/2003

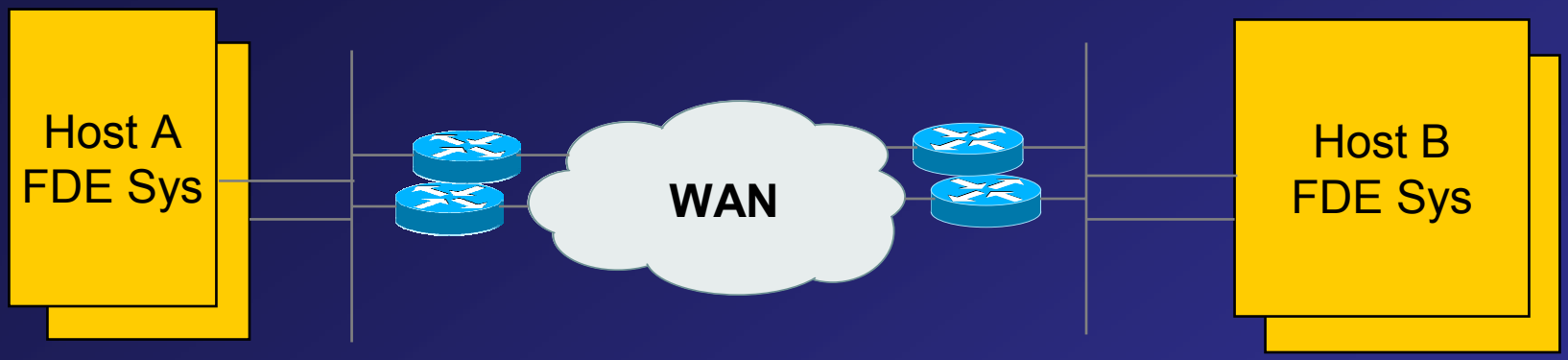
Phase II Overview

- Build on Phase I architecture.
- CPDLC over IPv6 trials.
- OLDI over IPv6 trials.
- Real-time streaming media
- Quality of Service
- Voice over IP
- Public Key Infrastructure and Security

CPDLC over IPv6



OLDI over IPv6



Host A : IP address 194.100.100.2
FDE Sys TCP port = random

Host B : IP address 193.221.168.100
FDE Sys TCP port = 8500 (well known port)

1 IP SRC 194.100.100.2
IP DST 193.221.168.100
TCP Port SRC 15256
TCP Port DST 8500

TCP Client Connect Request

2

3 IP SRC 193.221.168.100
IP DST 194.100.100.2
TCP Port SRC 8500
TCP Port DST 15256

4 TCP informs FDE Sys of an established connection

Summary

- Identified an area for innovation in Aviation.
- Established relationships with industry partners and organizations.
- Verified basic IPv6 connectivity requirements
- CPDLC over IP, and OLDI over IP tests are ramping up.
- The use of Mobile-IPv6 to connect different ATC networks is being tested.

Questions and Contact Info

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